Cosmic Ray Background Simulations

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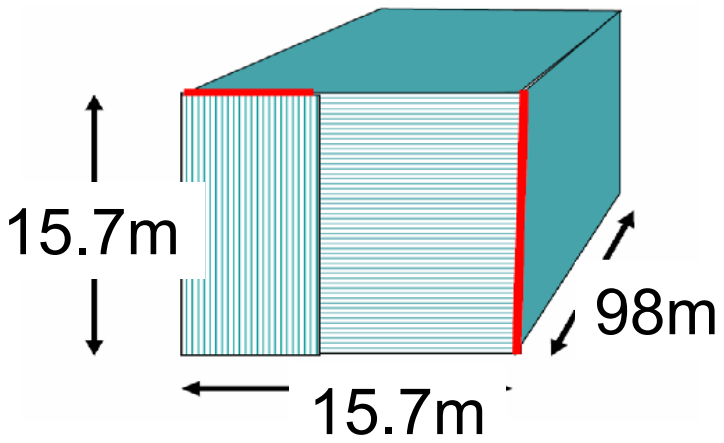
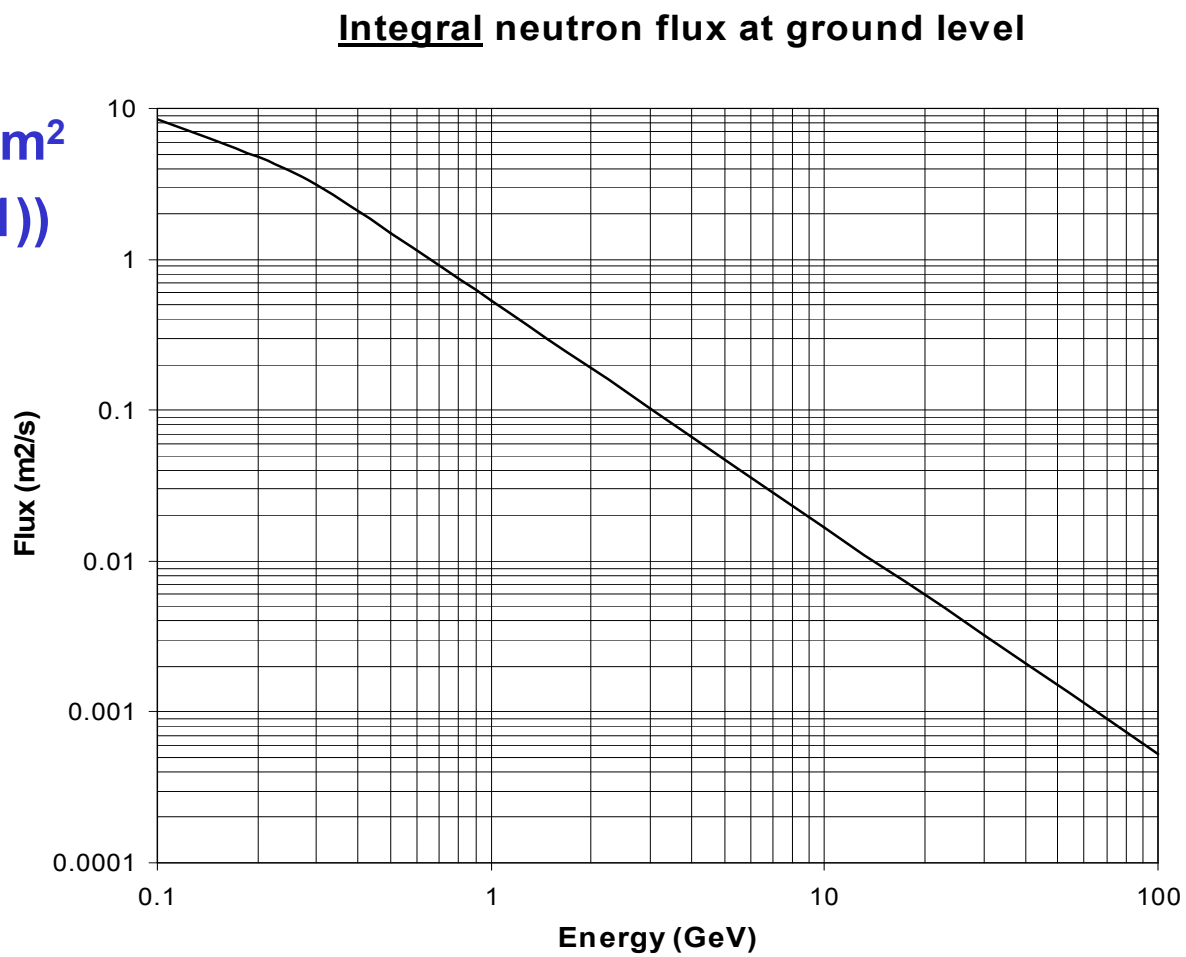
Simulations of Cosmic Ray Induced Backgrounds

- Ground-level neutrons – remnants of extensive air showers (atmosphere is calorimeter with ~$8\lambda_{int}$)
- Detector: 15.7x15.7x98m ~1500 m^2 effective area)
- Generate Neutron flux with
  - **fixed zenith angle**
  - **random energy (flat 1-5GeV)**
  - **random azimuthal angle**
  - **random position on detector**
- Analyze with PJL standard selections



Neutrons

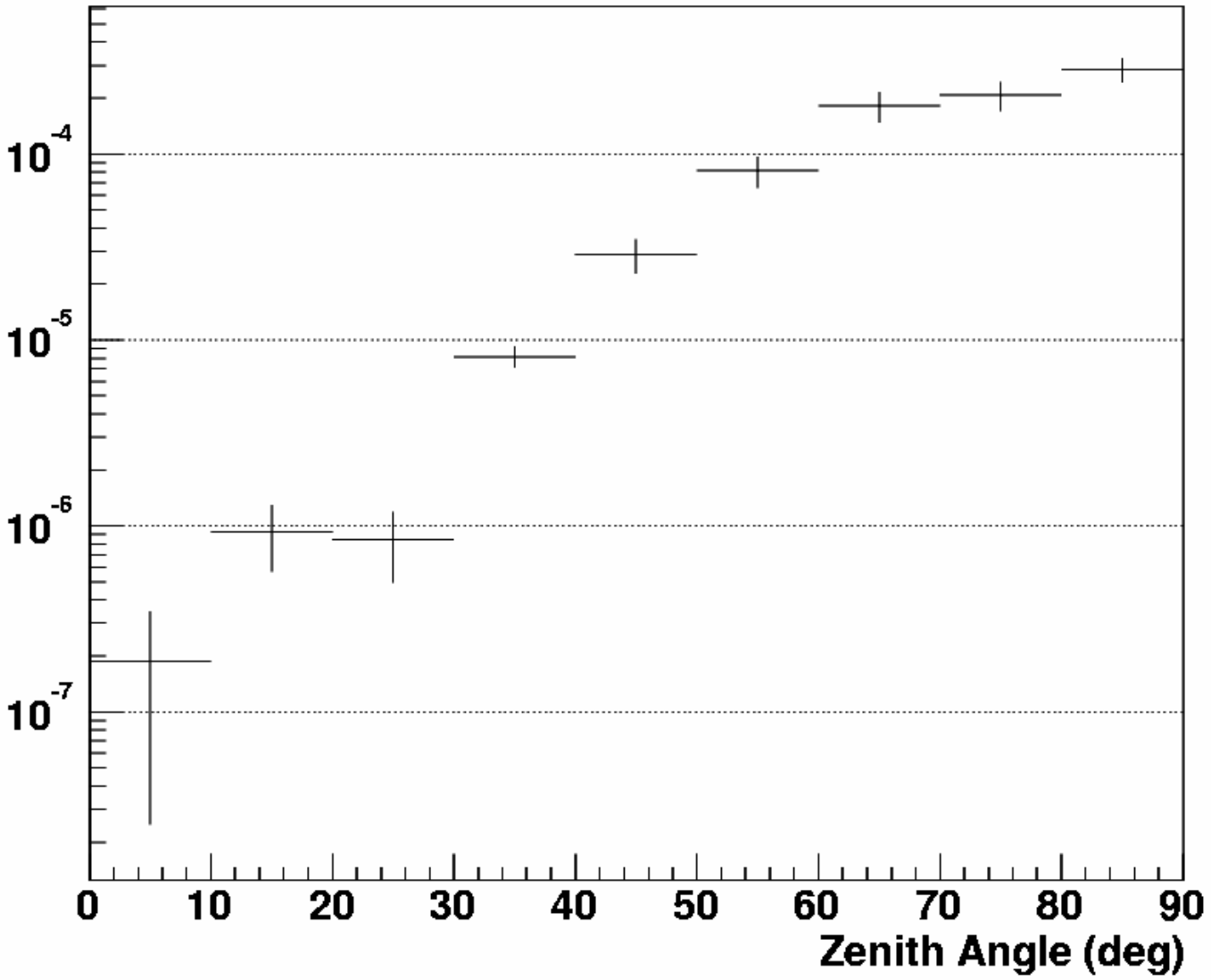
- Data from Ashton, "*CR at ground level*", ed. Wolfendale (1974)
- Atten. Length: ~120 g/cm^2
- $I(\theta) \approx I(0)\exp(-8(\sec\theta - 1))$



Selection Probability

(Using Standard Analysis)

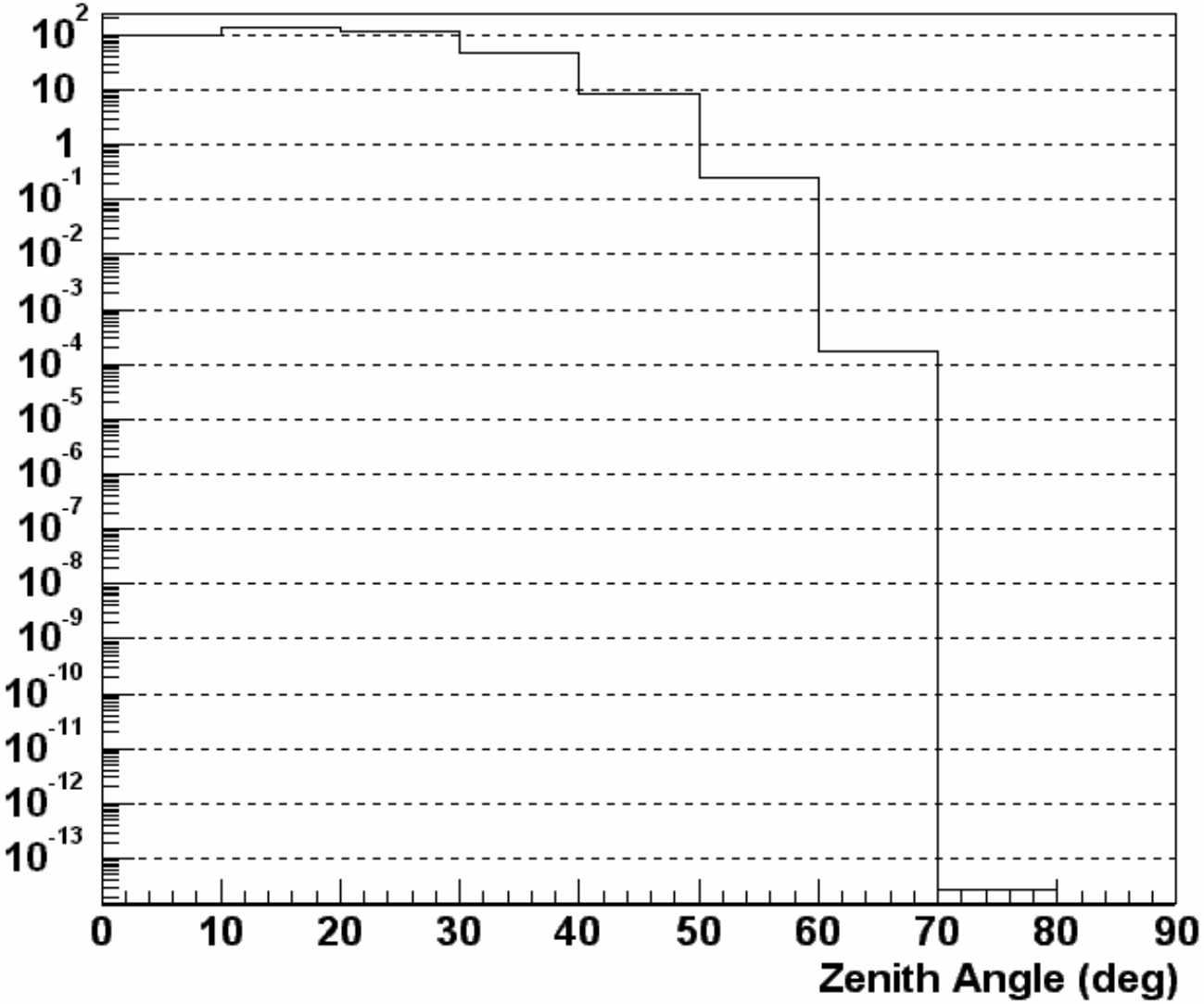
Probability of selecting a neutron as a function of zenith angle: P(θ)



Neutron Rate vs. Angle

Integral neutron rate (neutrons/s) as a function of angle:

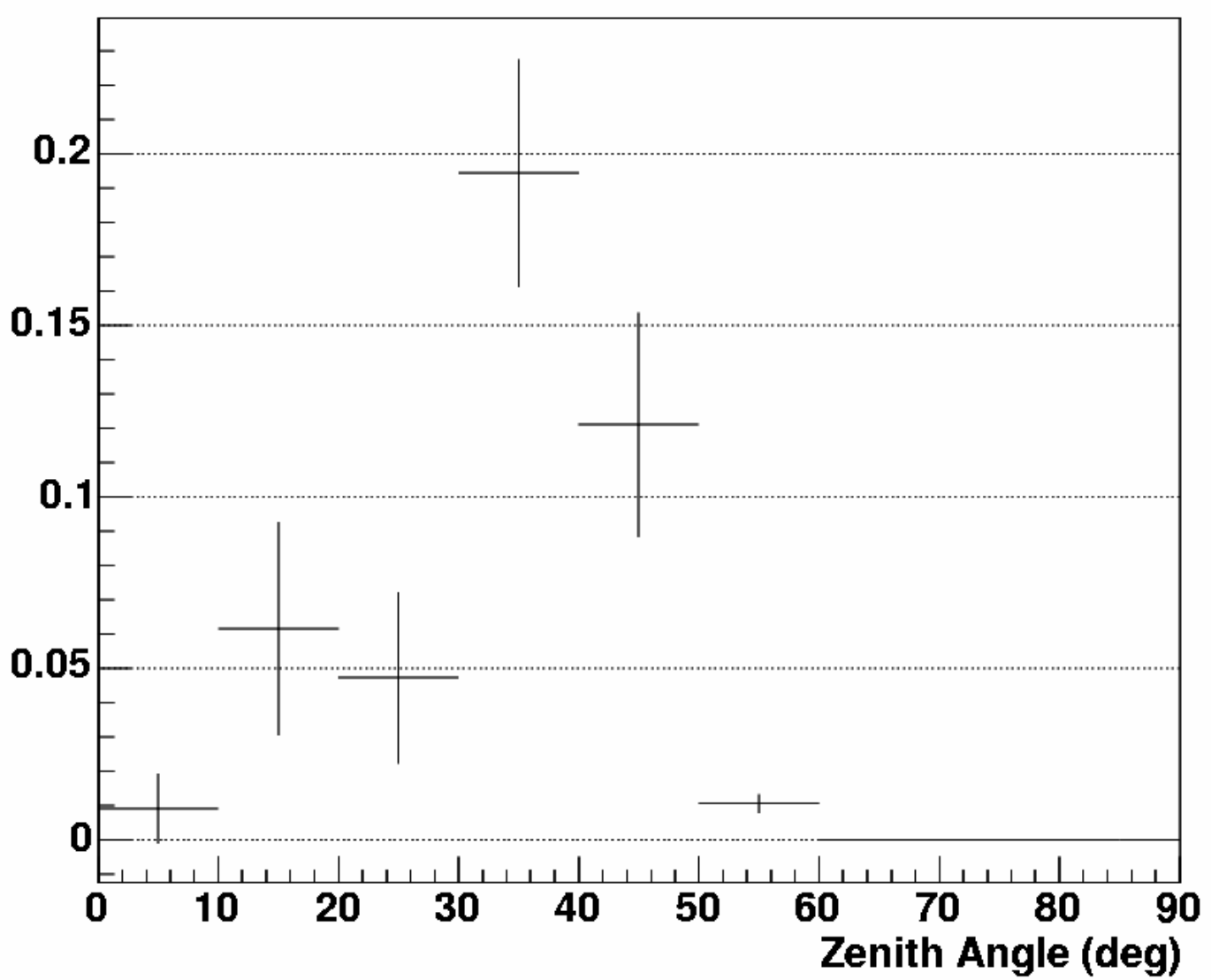
$R(\theta) = I(0) * \exp(-8(\sec\theta - 1)) * \text{acceptance}(\theta)$



Selected Events Distribution

$N(\theta) = P(\theta) * R(\theta) * T$

Total Events =0.44 in 5 year exposure (500s live)



Photon Background

Considered likely to be selected as electron event –EM interactions

- **Angular suppression not as strong as neutrons**
- **Difficult to simulate correctly (easily)**
  - Photons are from hadronic interactions production of π^0; Associated particles should aid rejection
    - Need to start with parent particles –N or P
  - Photons can be seen from relatively far away
    - Need to simulate large volume (X_0=300m!)
- **Estimate upper limit by simply simulating the photons as was done for neutrons**

Current Status and Plans

- Consider Neutron background complete
- Start simulating photons only, and see where it leads
- Check literature for photon angular and energy distribution

Electrons and photons

- Data from Daniels and Stephens; Revs Geophys. And Space Sci. 12, 233(1974)
- ”$\cos^2\theta$ for $\theta < 60^o$
- Median energy ” 10s of MeV
- Attenuated as ”$\exp(-x/175 g.cm^{-2})$